STAR LAKE GOLD MINE

ENVIRONMENTAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

SASKATCHEWAN MINING DEVELOPMENT CORPORATION

AUGUST, 1985

EXECUTIVE SUMMARY

INTRODUCTION

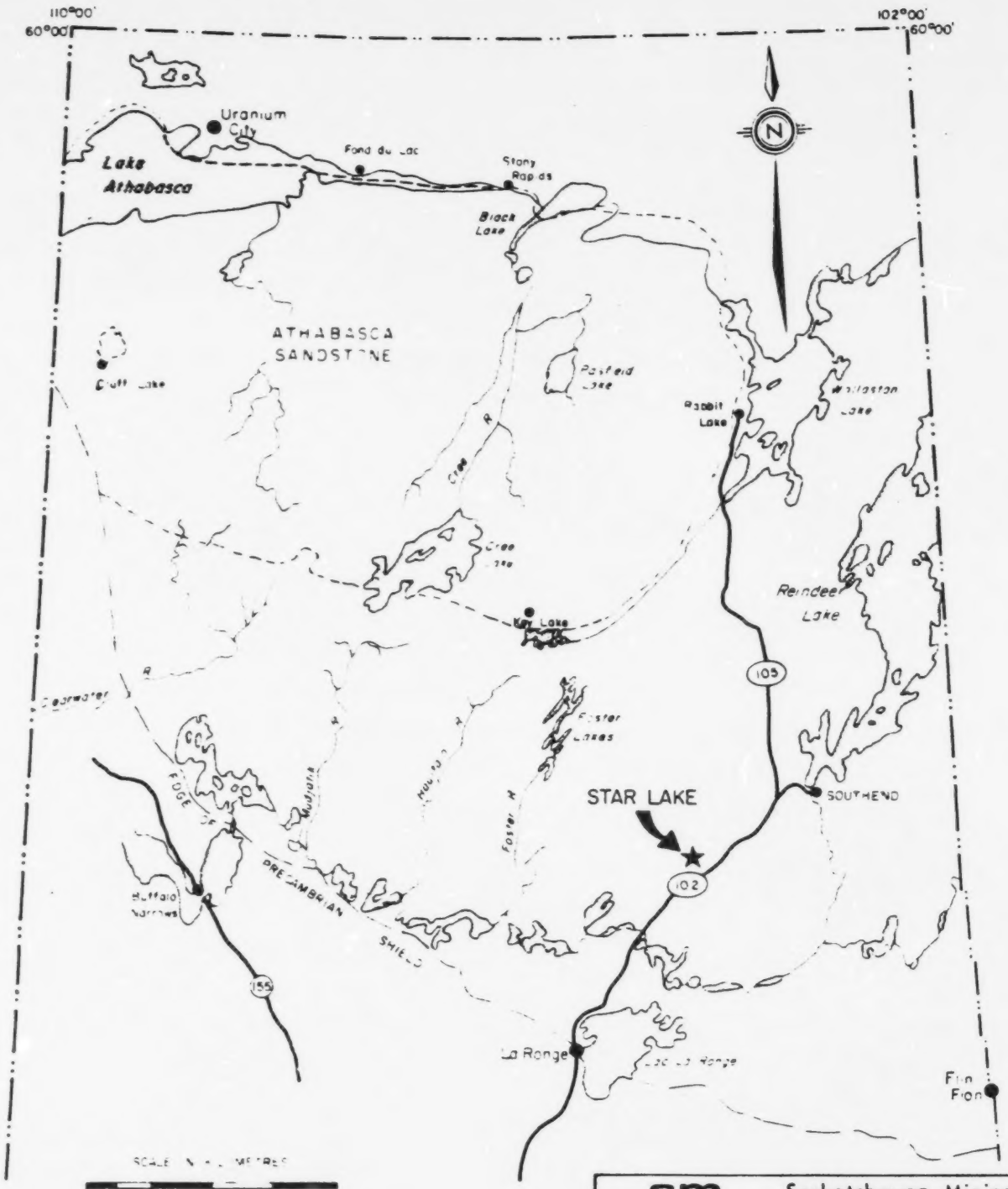
The purpose of this report is to examine the socio-economic and environmental impacts which the proposed Star Lake Mine project will have on the surrounding area. The Star Lake Project is a joint venture between the Saskatchewan Mining Development Corporation (SMDC 50%; operator) and Starrex Mining Corporation Limited (50%), and consists of mineral leases ML5100 and ML5118. The project site is 137 km northeast of La Ronge and present access is by float equipped aircraft or tracked vehicle. A 10.2 km road from Highway 102 is planned to provide access to the site.

The project will consist of an underground mining operation, a 200 tonne per day unitized mill, a work camp and a waste management facility. Power will be generated on site. The Environmental Impact Statement (E.I.S.) details the potential impact of the mining, milling and tailings process along with the mitigation of those impacts. The E.I.S. is based on one full year of environmental baseline data gathering, and is the combined labour of SMDC staff and a number of consulting firms.

Construction is scheduled to commence in September 1985, and production in June 1987, pending approval of the regulatory agencies. The current reserves would be mined out and the area under reclamation by December 1989.

The Public Participation Program clearly demonstrated that there is support for the project throughout the regional population.

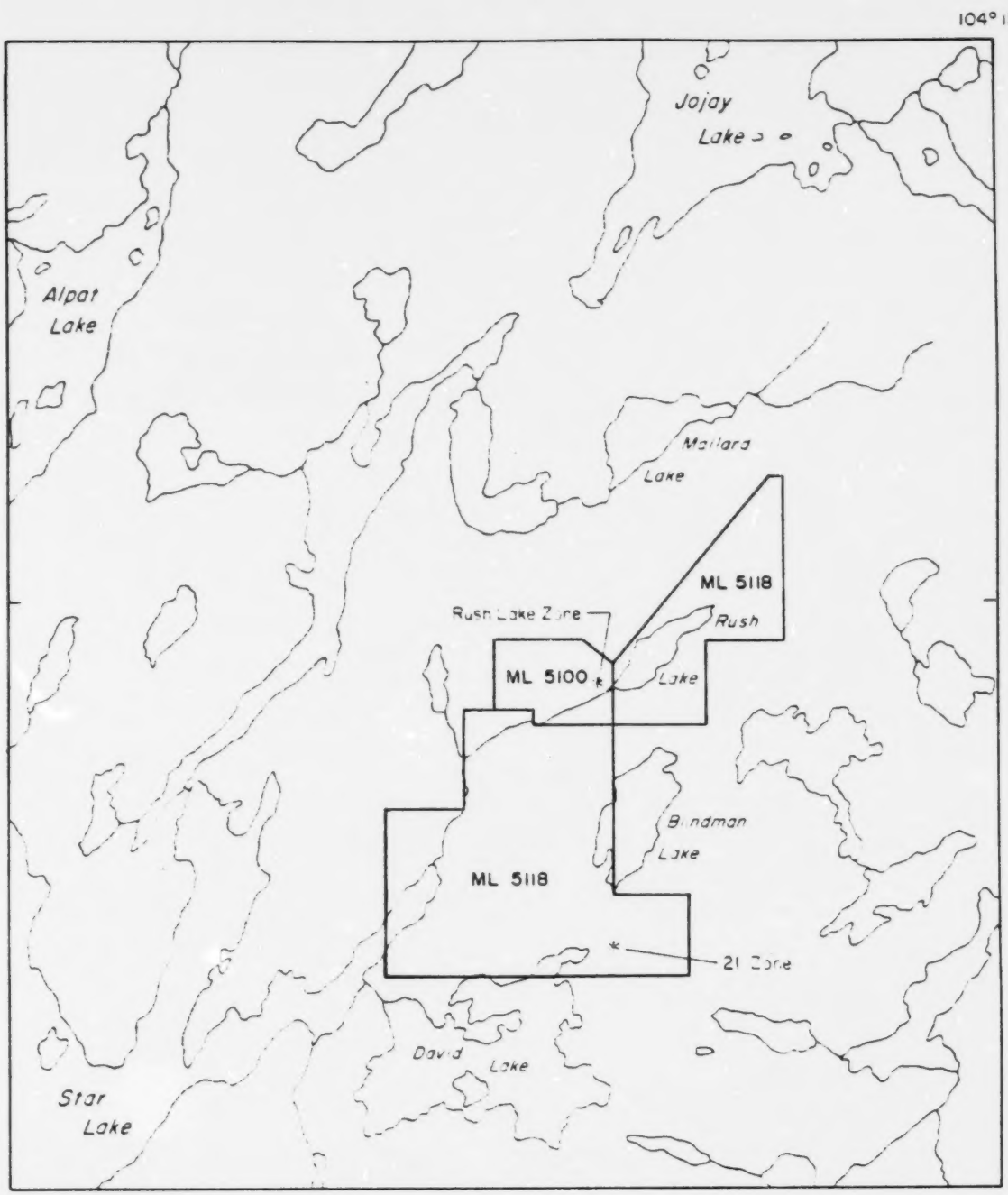
The Socio-Economic Impact Assessment showed that the positive direct, indirect and induced economic and employment impacts which will be created within the province by the project will significantly outweigh any potential short-term negative or residual environmental impacts. The project will generate approximately $34.4 million of gross revenues to the



smdc Saskatchewan Mining Development Corporation

Location Map

PROJECT STAR LAKE		
NTS 73-P, 6, 74-A-1	DISPOSITION ML 5100, 5118	
WORK BY C. BURTON	SCALE 1:3,200,000 (1"=50.5mi)	
DRAWN C.D. DURBIN	DATE JULY/84	FIGURE 2.1



0 400 1000 1500 m
0 1000 2000 3000 4000 5000 ft

Saskatchewan Mining Development Corporation	
Property Map	
PROJECT: STAR LAKE	
N.T.S. 73 P/6, 74 A/1	LOCATION: ML 5100, 5118
WORK BY: C. BURTON	SCALE: 1:30,000 (1" = 2500')
DRAWN: C.D. DURBIN	DATE: JULY/84 FIGURE 1.2.2

owners (assuming a minimum gold price of $400.00 Canadian per oz.). The project will result in approximately $23.82 million of direct expenditures within Saskatchewan on goods, services, taxes, royalties and salaries. Between 410 and 480 person years of direct, indirect and induced employment will be created over the project's 3.5 year duration.

Should the project not proceed, the postive economic and employment impacts noted above would be lost to the provincial economy and labour force.

GEOLOGY AND ORE RESERVES

The property lies within the La Ronge Domain, a sequence of metamorphosed sedimentary and volcanic rocks with related intrusives which extends from La Ronge northeast into Reindeer Lake and Manitoba. The ore zone (21 Zone) is found within a northeasterly trending structure within the granitic to dioritic Star Lake intrusive.

The gold is found as very fine particles associated with pyrite in a massive quartz zone which has a strike length of 80 m, near vertical dip, a minimum depth of 180 m, widths up to 14 m and plunging to the southwest.

The geostatistical calculation of mineable, diluted reserves indicates 181,367 tons grading 0.477 oz/ton or 164,500 tonnes grading 16.362 g/tonne gold to 130 m depth.

MINING

Examination of diamond drill core and local outcrop indicates that both the ore zone and host rocks are very competent structures. There is very little evidence of weakness or 'gouge' associated with the sequence, nor of any ground water movement of consequence. A blast hole open stope mining method is proposed for the most part with supplementary output from

shrinkage operation. Mine entry is by trackless decline and vertical ventilation and service raises provide alternate access. Some adjustments to minor streamflows around the sub-crop of the ore body and to local lake levels are projected for ready surface access and as insurance against mine flooding. A contract mine development and stoping program is proposed. The decline layout is designed to allow ease of underground exploration and definition drilling.

MILLING

Bench scale test work has been undertaken on composites of Star Lake drill core selected to match mining plans. The work has been completed in sufficient detail to indicate the most promising process flowsheet although some further testing may be required to finalize the detailed design. The gold is very fine grained and will require a fine grind to effect liberation. The ore is free of undesirable contaminants. The proposed flowsheet is a conventional carbon-in-pulp circuit with natural degradation of cyanide in the waste management area. The mill process and equipment selected is based on a compromise between simple operation and maximum recovery and, as specified, has a capacity of 200 t.p.d. for 340 days/year with a 93% gold recovery projected. The mill construction will minimize on-site activity by utilizing prefabricated buildings and modularized components wherever possible.

WASTE MANAGEMENT

The tailings from the Star Lake mill represent the greatest potential impact to the environment from the project. The Star Lake ore is primarily a quartz rock with pyrite inclusions with low arsenic and heavy metal content. Management of the mill tailings will provide for permanent stabilization of the finely ground material and the necessary retention time for the solution to allow elevated cyanide concentrations to reach surface water quality objectives by a natural degradation process. A natural basin that is currently a muskeg has been selected for waste

management. The basin will be used to construct the tailings pond and a polishing pond to provide the capacity necessary for the life of the operation under the proposed operating plan.

MANPOWER

During construction the Star Lake project will provide approximately 780 person-months of employment with the number of jobs increasing from an estimated 32 during the third quarter of 1985 to 76 during the second quarter of 1986.

The majority of the jobs during the construction phase will require skilled personnel. Approximately two thirds of the construction phase jobs will be for contractor's employees.

During the production phase (July 1986 - December 1988) approximately 35 jobs are expected to arise from the mining contract and 36 workers will be required in the mill, maintenance, supervision and administration of the project.

The point of hire will be La Ronge.

EXISTING ENVIRONMENT

Meteorology and Air Quality

The nearest centre to Star Lake with a complete meteorological record is La Ronge 137 km to the south. Since both areas have similar weather and climatic conditions, data from La Ronge was used to represent the climatic conditions at Star Lake. Data on wind speed, wind direction, temperature and precipitation were gathered from La Ronge and are used to help predict environmental conditions and impacts. For instance, it is very important to know the amount of rainfall in the design and operation of the tailings pond. At-site dustfall and sulphation readings were taken, and all values

met or were less than provincial standards. A temporary increase in dust and sulphation was noted near areas of active drilling.

Surficial Geology and Soils

The project lies in an area of moderate relief composed of ice-scoured bedrock, topographic highs covered with a thin veneer of till and/or organic material, and depressions filled with peat, muskeg or water. Soils are generally poorly developed and only in localized areas of deeper, well drained till is mixed forest generated.

Surface Hydrology

The Star Lake mineral disposition boundaries and all development activity, except the access road, lie within the upper portion of the 23.84 km^2 Star Lake's watershed. Star Lake drains into Alpat Lake which in turn drains into the La Rocque and Forbes Lakes system.

Stream flows and lake levels were monitored from May to October, 1984. Star Lake water level remained relatively constant throughout the survey period.

Since the mining of the ore zone will be done under a muskeg, two minor water diversions will be undertaken. One is the diversion of the Blindman Lake drainage creek, and the second is the damming and temporary redirection of water from the swamp above the mine site.

Hydrogeology

Ground water in the vicinity of the 21 Zone is not considered a problem because of the competency of the granitic rock in which the ore resides. Some water will enter through the rock unit, from process water used in mining, and seepage from surface. This water will be pumped to surface, its quality checked and will be discharged to the environment if it meets water quality objectives; otherwise it will be sent to the mill for use as process water.

A field test program including till sampling, diamond drilling, ground water sampling and piezometer installation was carried out in February and March, 1985 in the tailings area. The tailings pond sits on relatively fractured, weathered metavolcanic rocks and the potential exists for some ground water movement towards Star Lake and David Lake. However, the current absence of detectable ground water discharge in the tailings pond despite the higher elevation of David Lake indicates that the rock is relatively tight not only on the east side of the pond but also on the southerly (David Lake) side. There are also a number of other natural barriers to seepage including the 2 metres or more of well-graded relatively fine grained till overlying the site, and a surficial organic layer.

Monitoring wells and drainage galleries will be installed and if contaminated water is detected it will be pumped back to the tailings pond.

Water Quality

Six water quality sampling stations were established in the Star Lake watershed. Sampling was carried out in the fall, winter, spring and summer seasons. Sediment sampling was conducted during the summer and winter seasons, and field measurements were taken for dissolved oxygen, specific conductivity and pH. Analyses were done in accordance with Saskatchewan Department of Environment directives.

Ground water was sampled for quality analysis from two artesian drill holes in the ore zone, and from the piezometers installed in the tailings area.

Surface water is characterized as slightly acidic to slightly basic (pH 6-7.5) with a seasonal variation up to 1.5 pH units. The waters were typical of most Northern Saskatchewan surface waters, having poor buffering capacity. The lakes are found to have deficient to moderate nutrients.

Analysis of ground water from the "21 Zone" indicates different chemical composition from Blindman or David Lakes water or the muskeg water, showing an increase in both alkalinity and pH. Ground water samples from the tailings area indicate water of high quality. No anomalies of concern were noted.

Fisheries Resources

Spring spawning investigations on several streams flowing into Star Lake and David Lake and on portions of the lakes themselves revealed only limited northern pike spawning and no pickeral. Pike spawning was noted in the creek entering the northeast arm of Star Lake, but the extent of suitable spawning habitat was limited to 400 m of the creek shoreline. Spawning by pike in the northeast arm of the lake itself appears unlikely as the lake margin is not characteristic of northern pike spawning habitat.

David Lake does not appear to support a northern pike population, due in part to the lack of suitable spawning habitat. Suitable habitat for spawning is limited to a 50 m stretch of the inflowing creek and no spawning pike were found. White suckers appear to be the only spring spawning fish in David Lake. Netting below the ice in David Lake to obtain samples for fish tissue analysis resulted in no game fish being caught. Similarly, a fall netting in David Lake resulted in no fish.

No commercial or sports fishing is carried out in the lakes of the area.

Due to their shallow nature and marginal winter oxygen levels, Rush Lake and Blindman Lake are not considered to support any significant fish populations.

Wildlife Resources

Information on wildlife and wildlife habitat was obtained by means of an aerial survey, inspection of coloured air photos and forest cover-type maps, a snow toboggan ground survey, and verbal and written communication with trappers and Saskatchewan Department of Parks and Renewable Resources staff.

Woodland caribou were observed at a density of 0.025 per km^2. No moose were observed in the big-game survey. Fur harvest records of the trapper utilizing the area indicate that the primary species taken in descending order of numbers are red squirrel, muskrat, beaver, mink, fox, weasel and fisher. Relatively low numbers of beaver probably reflect the lack of aspen and willow in the area. Only one Black bear has been seen in the area in three years.

Casual observations of birds in the general project area during the period January to September, 1984 resulted in positive identification of forty-four species. Threatened or endangered species which may occur in the project vicinity include white pelican, piping plover, peregrine falcon and caspian tern, none of which has been observed. One bald eagle nest was noted, some distance from the project site.

Forest Vegetation

The project is located within the Northern Coniferous Section of the Boreal Forest Region. In this section climatic conditions allow reasonable tree growth and development of closed forests. Black spruce is the predominant tree forming dense stands on the thin soils of the uplands with minor poplar, jack pine and birch in areas of deeper till. In the poorly drained lowlands black spruce and tamarack occur. Merchantable timber is rare in the area, the majority being overmature or undersized.

Heritage Resources

While the potential for the presence of a significant heritage resource is considered small, a reconnaissance level archeological survey of the property will be carried out in those areas where ground disturbance will occur, upon removal of the vegetation. There are no known archeological sites in the project vicinity.

Land Use

In recent years mineral exploration has been the principal land use. Trapping is the other land use of consequence. None of the lakes in the area are commercially fished nor have commercial fishery potential. There has been no forest utilization in the area to date. Sports fishery in the vicinity of the project appears to have low potential, with pike the only game species noted.

There are no recreational leases, and Star Lake is not part of any designated canoe route.

POTENTIAL ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION

For the Star Lake project, the environmental impact assessment has not revealed any significant, long-term impacts.

In order to minimize impacts associated with access road construction and maintenance, strict adherence to the appropriate guidelines will be followed, namely "Guidelines for Environmental Protection during Road Development" (Sask. D.O.E., September 1981); "Guidelines for Environmental Protection during Restoration of Sand and Gravel Pits" (Sask. D.O.E., September 1984); and Department of Parks and Renewable Resources Procedure #420-44, "Rights-of-Way Construction and Salvage".

No environmental impacts are predicted for the camp, which will be sited and constructed in accordance with the applicable "Mineral Exploration Guidelines" (Sask. D.O.E., March 1983).

Activities associated with the mine which may have potential for environmental impact include creation of the mine storage yard, contractor's yard, stockpiling of ore, stream diversions, fuel storage and mine water disposal.

The use for spawning of the inlet creek through the muskeg overlying the ore zone would be removed during diversion. Studies have shown this to be limited to white suckers only, with no game fish observed. On decommissioning the stream would be restored to its original channel.

Dust suppression measures underground will minimize environmental dust releases.

A possible need to lower the level of David Lake to protect the underground mine workings would impact the fishery of that lake. Studies have shown that David Lake does not support a game fish population, and the impact would be limited to the spawning habitat of white suckers along the lake margin.

The lake would be returned to its original level at decommissioning, and stocking of it with game fish could be investigated.

All fuel and lubricant storage facilities will be surrounded by impermeable dykes to confine spillage. Contaminant spills on site will be handled and reported in accordance with Saskatchewan Spill Control Regulations. A raised rim will be incorporated in the mill floor concrete which will contain spills up to the magnitude of the largest tank in the building.

The major potential for impact from mill operation relates to the handling of mill effluent in the tailings pond. A careful review of a number of possible sites was undertaken before selection of the preferred site. Hydrogeological and geotechnical investigations in the tailings pond area identified that possible seepage sources into the ground water system would have no impact on the surrounding lakes due to the attenuation supplied by the substrata. As part of the operation the tailings pond and surrounding area will be monitored for contaminant migration with the installation of wells and drainage galleries.

Tailings pond effluent would be discharged into the environment only when it meets required regulatory requirements.

A diversion ditch or berm will minimize surface runoff into the tailings pond, and a tertiary dyke constructed downstream of the tailings pond dyke would contain any sudden unexpected release and allow for its collection and treatment.

SOCIO-ECONOMIC IMPACTS

The Public Participation Program clearly demonstrated there is support for the project throughout the regional population. This support, while widespread, is conditional upon the regional business sector and labour force deriving positive economic and employment opportunities. Questions and issues raised during informal discussions with community/band leaders and at the five formal public meetings generally focused on the technical aspects and operating procedures the operator will use to protect the environment and land users. Also of concern were the methods the operator intends to use to maximize regional business and employment opportunities. The small scale and short duration of the project was recognized.

The Socio-Economic Impact Assessment clearly demonstrated that the positive direct, indirect and induced economic and employment impacts which will be created within the province by the project will significantly outweigh any potential short-term negative or residual environmental impacts. The project will generate approximately $34.4 million of gross revenues to the owners (assuming a minimum gold price of $400.00 Canadian per oz.). The project will result in approximately $23.82 million of direct expenditures within Saskatchewan on goods, services, taxes, royalties and salaries. Between 410 and 480 person years of direct, indirect and induced employment will be created over the project's 3.5 year duration.

Should the project not proceed the positive economic and employment impacts noted above would be lost to the provincial economy and labour force.

DECOMMISSIONING AND RECLAMATION

The decommissioning and reclamation of the Star Lake mine, mill and camp complex will be an ongoing process during the life of the project.

As the mine and mill arrive at the end of their economic life they will be decommissioned in compliance with the Government regulations in force at the time.

The objective will be to return the site effected by the project to physically and chemically stable and aesthetically acceptable conditions.

The access road may have extended use beyond the life of the Star Lake project. There is a lot of exploration activity in the general area and the possibility exists for the use of Star Lake for recreational purposes; it is unlikely that the road would be abandoned upon completion of its use by SMDC.

However, should this not be the case, SMDC would be prepared to close out the road. This would involve trimming and contouring the borrow pits to leave a condition adaptable to natural regeneration for vegetative cover, removal of stream crossing installations, and scarifying of the roadbed to encourage natural regeneration, all in accordance with the requirements of the Guidelines for Environmental Protection During Road Development.

The camp primarily consists of mobile trailers. The trailers will be disassembled and removed from the site. Any salvageable components would be shipped for recycling, while worthless items left over would be moved to a landfill disposal site.

After shutdown of the mill, all equipment, parts, reagents and buildings would be removed from the site. It is anticipated that the major milling components will be sold for use at other properties. All remaining components with no real value would be transported to the landfill site for disposal. The mill building would be removed and all foundations work above ground level will be removed. The area would be left in a condition adaptable for natural vegetation.

The mine close out will be done as per the Occupational Health and Safety Act. The operator would give written notice of the mine closure to the Chief Mines Inspector with adequate lead time.

The waste stockpiles would be contoured in order to minimize erosion potential and facilitate natural vegetation growth.

Streams diverted away from mine workings will be allowed to flow in their original routes. Any material utilized in the stream diversion will be removed from the site.

All temporary buildings and other facilities, viz., mine dry, cold warehouse, maintenance shops, pipelines, power generators and distribution lines, etc. will be removed from the site and reclaimed.

All salvageable components will be removed for disposal and other items with no savageable value will be disposed of in the landfill site.

Tailings area abandonment will have three objectives, namely the continued attenuation of any undesirable effluents being released by the tailings, the modification of tailings dykes to minimize erosion and the reseeding of the tailings area surface in order to restore aesthetic value and habitat. The seepage analysis has indicated that the cyanide will not penetrate the overburden in the waste management area during the life of the operation. Since the natural ground water level creates a discharge into the tailings basin timely reclamation can prevent contaminants from moving into the underlying bedrock. Following the final release of water

from the waste management area the natural water table will be restored by breaching the earth filled dam in the primary holding pond and partially breaching the dam in the polishing pond. To facilitate the dewatering of the tailings several trenches will be excavated in the tailings. The remaining portion of the polishing pond will have the dual purpose of collecting any tailings erosion and providing a final aging for the water draining from the tailings. The small pond would have capacity of more than a year after which it would overflow naturally. The road berm along the side of the tailings pond would be left in place to continue to divert surface runoff away to prevent erosion.

The tertiary control structure at the Star Lake inlet and the control structure at David Lake would be removed after pond reclamation is completed.

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